

# PATENT ABSTRACTS OF JAPAN

11

(11) Publication number : 09-298365

(43) Date of publication of application : 18.11.1997

---

(51) Int.Cl.

H05K 3/46

H05K 1/11

---

(21) Application number : 09-048217 (71) Applicant : IBIDEN CO LTD

(22) Date of filing : 03.03.1997 (72) Inventor : KAWAMURA YOICHIRO

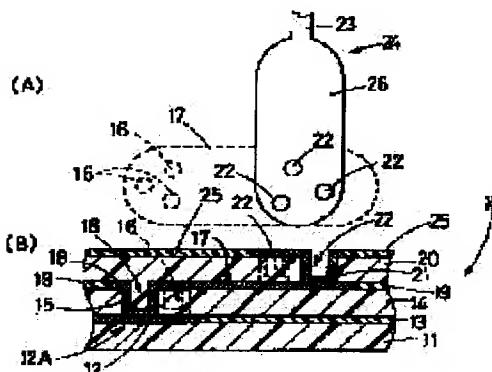
---

(30) Priority

Priority number 08 75297 Priority date 04.03.1996 Priority country JP  
:

---

**(54) MULTILAYER PRINTED-WIRING BOARD**



**(57) Abstract:**

**PROBLEM TO BE SOLVED:** To provide a multilayer printed-wiring board in which the connection reliability of a lower-layer conductor circuit to an upper-layer conductor circuit can be maintained surely as the whole wiring board, even when connection defects are generated in some out of a plurality of via holes, by a method wherein the plurality of via holes are formed aggregately when the via holes are formed in an interlayer insulating layer.

**SOLUTION:** When a connecting pad 12 on a substrate 11 such as an insulating substrate or a multilayer printed-wiring board is connected to a connecting pad 17 on an interlayer insulating layer 14, and when the connecting pad 17 is connected to a connection part 26 at an upper-layer

conductor circuit 24 on an interlayer insulating layer 20, a plurality of via holes 16, 22 are constituted to be formed aggregately in such a way that their lands are owned jointly. Even when some out of the plurality of via holes 16, 22 are disconnected, the connection reliability of a multilayer printed-wiring board 10 can be maintained surely through the remaining via holes 16, 22.

[Claim(s)]

[Claim 1]In a multilayer printed wiring board to which a layer insulation layer is formed on a substrate with which a lower layer conductor circuit was formed, an upper layer conductor circuit is formed on the layer insulation layer, and it electrically comes to connect said lower layer conductor circuit and an upper layer conductor circuit via a viahole, A multilayer printed wiring board characterized by two or more said viaholes' gathering and coming to form them.

[Claim 2]The multilayer printed wiring board according to claim 1 which said viahole shares the land, and it gathers and comes to form.

[Claim 3]The multilayer printed wiring board according to claim 1 in which said viahole shares the land, and they gather, it comes to form it, and the land shape is tear drop shape, elliptical, the shape of an ellipse, or a circle configuration as a whole.

[Claim 4]The multilayer printed wiring board according to claim 1 with which it comes to carry out 2·5·piece set formation of said viahole.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]In this invention, the lower layer conductor circuit formed in the substrate and the upper layer conductor circuit on the layer insulation layer provided in the substrate are faced forming a viahole in a layer insulation layer especially about the multilayer printed wiring board connected via the viahole, it gathers and two or more viaholes are formed. Therefore, when a faulty connection occurs in some among two or more viaholes, it is related with the multilayer printed wiring board which can hold certainly the connection reliability of a lower layer conductor circuit and an upper layer conductor circuit as the whole patchboard.

[0002]

[Description of the Prior Art]In recent years, a miniaturization or improvement in the speed of electronic equipment is advanced by development of electronic industry, and the densification by fine-patternizing is increasingly required also in the various patchboards which mount a printed wired board and LSI in connection with this. In order to perform such densification, the multilayer printed wiring board called what is called a build up wiring board is the most preferred.

[0003]In a multilayer printed wiring board, multilayer connection structure is realized by connecting a connection pad and a pattern one by one via a viahole from before under this situation. Here, in the conventional multilayer printed wiring board, the connection pad formed in the substrate and the pattern on the layer insulation layer provided in the substrate are explained based on drawing 4 about the connection structure connected via a viahole. Drawing 4 shows the connection structure of connecting the connection pad formed in the substrate with the conventional multilayer printed wiring board, and the pattern on a layer insulation layer via a viahole, drawing 4

(A) is a top view of a multilayer printed wiring board, and drawing 4 (B) is a sectional view of a multilayer printed wiring board.

[0004] In drawing 4 (A) and (B), the multilayer printed wiring board 100 has the insulating base material 101 used as a substrate, and the through hole 102 is formed in this insulating base material 101. The conductor layer 103 is formed in the wall of the through hole 102 by through hole plating, and the circular through hole land 104 which follows the conductor layer 103 by up-and-down both sides of the insulating base material 101 is formed. In the upper surface of the insulating base material 101, the through hole land 104 is connected to the circular connection pad 106 via the connection pattern 105. The connection pad 106 is formed also in the position estranged from the through hole land 104 on the undersurface of the insulating base material 101. The filling resin 107 is filled up with the inside of the through hole 102, and both sides of the insulating base material 101 between the through hole land 104, the connection pattern 105, and the connection pad 106 and other circuit patterns.

[0005] The layer insulation layer 108 is formed in the upper surface of the insulating base material 101, and in the position corresponding to the connection pad 106 by this layer insulation layer 108. While the viahole 110 in which the conductor layer 109 was formed is formed in an inside, the circuit pattern 111 linked to the conductor layer 109 is formed. Thereby, the connection pad 106 is connected to the circuit pattern 111 via the conductor layer 109 of the viahole 110. Similarly, the layer insulation layer 108 is formed in the undersurface of the insulating base material 101, the viahole 110 which has the conductor layer 109 inside is formed in the position corresponding to the connection pad 106 by the layer insulation layer 108, and the connection pad 106 and the conductor layer 109 are connected mutually. The plating resist layer 112 needed for them when forming the conductor layer 109 and the circuit pattern 111 in the conductor layer 109 of the viahole 110 and the circumference of the circuit pattern 111 via an electroless plating process is formed.

[0006] Next, the pattern on a layer insulation layer different from the connection pad formed in the layer insulation layer is explained based on drawing 5 about the connection structure connected via a viahole. Drawing 5 shows the connection structure of connecting the pattern on a layer insulation layer different from the connection pad formed in the layer insulation layer with the conventional multilayer printed wiring board via a viahole, drawing 5 (A) is a top view of a multilayer printed wiring board, and drawing 5 (B) is a sectional view of a multilayer printed wiring board.

[0007] In drawing 5 (A) and (B), the multilayer printed wiring board 120 has the insulating base material 121 used as a substrate, the connection pad 122 is formed in the upper surface of this insulating base material 121, and the filling resin layer 123 is formed in the circumference of the connection pad 122. The layer insulation layer 124 is formed in the upper surface of the connection pad 122 and the filling resin layer 123, and in the position

corresponding to the connection pad 122 by this layer insulation layer 124. While the viahole 126 in which the conductor layer 125 was formed is formed in an inside, the circuit pattern 127 linked to the conductor layer 125 is formed. The connection pad 128 is continuously formed in the end (the inside of drawing 5 (A) and (B), left edge part) of the circuit pattern 127. Thereby, the connection pad 122 on the insulating base material 121 is connected to the connection pad 128 on the layer insulation layer 124 via the conductor layer 125 of the viahole 126, and the circuit pattern 127. The plating resist layer 129 needed for it when forming each conductor layer 125, the circuit pattern 127, and the connection pad 128 in the circumference of the conductor layer 125 of the viahole 126, the circuit pattern 127, and the connection pad 128 via an electroless plating process is formed.

[0008]Another layer insulation layer 130 is formed in the upper surface of the layer insulation layer 124.

While the viahole 132 by which the conductor layer 131 was formed in the inside is formed in the position corresponding to the connection pad 128 by this layer insulation layer 130, the circuit pattern 133 linked to the conductor layer 131 is formed.

Thereby, the connection pad 128 of the layer insulation layer 124 is connected to the circuit pattern 133 via the conductor layer 131 of the viahole 132. The plating resist layer 134 needed for them when forming the conductor layer 131 and the circuit pattern 133 in the conductor layer 131 of the viahole 132 and the circumference of the circuit pattern 133 via an electroless plating process is formed.

[0009]

[Problem(s) to be Solved by the Invention]However, in the conventional multilayer printed wiring boards 100 and 120, the connection pads 106 and 128 are only connected with the conductor layers 109 and 131 by only the one viaholes 110 and 132 so that clearly from drawing 4 and drawing 5.

[0010]the hole for viaholes provided in the layer insulation layers 108, 124, and 130 at this time when forming the viaholes 110 and 132 -- inside, Resin for forming layer insulation layer 108 grade may remain, in this case, bad insulation will occur between the connection pads 106 and 128 and the conductor layers 109, 125, and 131 of the viaholes 110 and 132, and it will be a faulty connection.

[0011]the hole for said viaholes, when the resin which remains inside is slight, It does not become a perfect faulty connection, but although the connection pads 106 and 128 and the viaholes 110 and 132 have flowed between the beginnings, it has a possibility that the conductor layers 109, 125, and 131 may separate by a thermo cycle, and will invite a faulty connection as a result.

[0012]Therefore, when at least one of the viaholes 110 and 132 which exist in the printed wired boards 100 and 120 is un-connecting, the printed wired board 100 and 120 the very thing become poor, and there is a problem that reliability falls.

[0013]This invention is made in order to cancel said conventional problem, and it is a thing.

the purpose by it being alike and facing forming a viahole, gathering and forming two or more viaholes, When a faulty connection occurs in some among two or more viaholes, it is providing the multilayer printed wiring board which can hold certainly the connection reliability of a lower layer conductor circuit and an upper layer conductor circuit as the whole patchboard.

[0014]

[Means for Solving the Problem]A multilayer printed wiring board applied to claim 1 in order to attain said purpose, In a multilayer printed wiring board to which a layer insulation layer is formed on a substrate with which a lower layer conductor circuit was formed, an upper layer conductor circuit is formed on the layer insulation layer, and it electrically comes to connect said lower layer conductor circuit and an upper layer conductor circuit via a viahole, Two or more said viaholes gather and it comes to form them. In a multilayer printed wiring board of claim 1, said viahole shares the land, and multilayer printed wiring boards concerning claim 2 gather, and it comes to form them.

[0015]In a multilayer printed wiring board of claim 1 and claim 2. From being formed, after a viahole shared the land and have gathered, when a faulty connection occurs in some among two or more viaholes, it becomes possible to hold certainly the connection reliability of a lower layer conductor circuit and an upper layer conductor circuit as the whole patchboard. [ two or more ]

[0016]It is desirable that it is tear drop shape, elliptical, the shape of an ellipse, or a circle configuration as the whole land as indicated to claim 3 as land shape of a viahole here. As the number of a viahole, 2-5 pieces are good as indicated to claim 4.

[0017]

[Embodiment of the Invention]It explains in detail, referring to drawing 1 for the multilayer printed wiring board concerning this invention hereafter based on the embodiment which materialized this invention. Drawing 1 shows the connection structure of connecting the pattern on a layer insulation layer different from the connection pad formed in the layer insulation layer via a viahole, drawing 1 (A) is a top view of a multilayer printed wiring board, and drawing 1 (B) is a sectional view of a multilayer printed wiring board.

[0018]In drawing 1 (A) and (B), the multilayer printed wiring board 10 has the substrate 11, and while the connection pad 12 which constitutes a part of lower layer conductor circuit 12A is formed in the upper surface of this substrate 11, the filling resin layer 13 is formed in the circumference of the connection pad 12. The layer insulation layer 14 is formed in the upper surface of the connection pad 12 and the filling resin layer 13, and in the position corresponding to the connection pad 12 by this layer insulation layer

14. The viahole [ two or more (the inside of drawing 1 three pieces) ] 16 by which the conductor layer 15 was formed in the inside is included, and the connection pad 17 which has the shape of an ellipse in general is formed.

[0019]Here, the ellipse-like connection pad 17 constitutes a part of interlayer conductor circuit here, and at the major axis direction end of the ellipse. Plurality which constitutes a part of upper layer conductor circuit 24 formed on the layer insulation layer 20 mentioned later (in drawing 1) While the viahole 22 which shared three lands, and was gathered and formed is connected, the other end of the major axis direction of the ellipse constitutes a part of viahole land 18 of said viahole 16. Thereby, the connection pad 12 on the insulating base material 11 is connected to the connection pad 17 from the conductor layer 15 of two or more viaholes 16 of each. it may be the shape (ellipse) where the ellipse of the connection pad 17 is formed in the shape where the neighborhood which a rectangle faces drew the circle towards the outside as obvious from drawing 1 (A), and the neighborhood which a rectangle faces drew the circle towards the outside further -- it is natural. Elliptical is shown in drawing 1 (C).

[0020]As for a viahole, it is desirable to come to carry out 25-piece set formation. Although a viahole will share a land and more than one will gather, it is because land area will have to be enlarged and wiring density will fall, if the number of a viahole exceeds five pieces.

[0021]The plating resist layer 19 needed for it when forming each conductor layer 15 and the connection pad 17 in the circumference of the connection pad 17 containing the conductor layer 15 of each viahole 16 via an electroless plating process is formed.

[0022]Another layer insulation layer 20 is formed in the upper surface of the layer insulation layer 14, While the three viaholes 22 by which the conductor layer 21 was formed in the inside are formed in the position corresponding to the end part (the inside of drawing 1 (A) and (B), right end section) of the connection pad 17 by this layer insulation layer 20, the upper layer conductor circuit 24 including the circuit pattern 23 linked to the conductor layer 21 is formed. Thereby, the connection pad 17 of the layer insulation layer 14 is connected to the circuit pattern 23 via the conductor layer 21 of each viahole 22.

[0023]The plating resist layer 25 needed for them when forming the conductor layer 21 and the circuit pattern 23 in the conductor layer 21 of the viahole 22 and the circumference of the circuit pattern 23 via an electroless plating process is formed. The upper layer conductor circuit 24 comprises the circuit pattern 23 which continues from ellipse-like as obvious from drawing 1 terminal area 26 and the terminal area 26 in which said each viahole 22 is formed like.

[0024]When a fully-additive process is adopted, it remains in a multilayer printed wiring board, but when it is a semiadditive process, the plating resist layer 19 and the plating resist layer 25 are removed after forming a connection pad with electrolysis plating. In the invention in this application,

any of a fully-additive process and a semiadditive process may be adopted. When adopting a fully-additive process, it is desirable to provide a roughened layer in the upper surface of conductor circuits, such as the conductor layer 15, the connection pad 17, the terminal area 26, and the circuit pattern 23. In the case of a semiadditive process, it is desirable to provide a roughened layer in the surface including the side of these conductor circuits. It is for preventing the crack which improves adhesion with a layer insulation layer and originates in a thermo cycle. As a roughened layer, the needlelike alloy roughened layer which consists of copper-nickel phosphorus, and the roughened layer by oxidation (melanism)-reduction processing are good.

[0025]Said multilayer printed wiring board 10 is manufactured as follows. Namely, by performing a predetermined etching process, resin filling, etc. to copper clad laminate, After forming the connection pad 12 which constitutes a part of lower layer conductor circuit 12A in the substrate 11, while applying a photopolymer to the upper surface of the substrate 11, drying on it and forming the layer insulation layer 14, It exposes, where the mask film (not shown) which has a shielding pattern equivalent to the connection pad 17 containing the viahole 16 and the viahole land 18 is stuck to the layer insulation layer 14. Negatives are developed by exfoliating from the layer insulation layer 14 in a mask film after exposure. Thereby, viahole 16 grade is formed. While giving a plating catalyst nucleus on the layer insulation layer 14, after forming the plating resist layer 19, conductor layer 15 grade is formed by performing electroless deposition. While applying a photopolymer, drying and forming the layer insulation layer 20 like the above, it exposes, where the mask film (not shown) which has a shielding pattern equivalent to the upper layer conductor circuit 24 including the viahole 22 and the circuit pattern 23 is stuck to the layer insulation layer 20. Negatives are developed by exfoliating from the layer insulation layer 20 in a mask film after exposure. Thereby, viahole 22 grade is formed. While giving a plating catalyst nucleus on the layer insulation layer 22, after forming the plating resist layer 25, conductor layer 21 grade is formed by performing electroless deposition. Thereby, the multilayer printed wiring board 10 is manufactured.

[0026]At this time, as a layer insulation agent for forming said layer insulation layers 14 and 20, The photopolymer which sensitization-ized thermosetting resin, such as an epoxy resin, polyimide resin, bismaleimide triazine resin, and phenol resin, and these, Or the complex of thermoplastics, such as polyether sulphone, thermoplastics, and thermosetting resin and the complex of a photopolymer and thermoplastics can be used. Roughening treatment of these surfaces may be carried out with an oxidizer, acid, alkali, etc. By roughening, adhesion with the conductor circuit formed in this surface is improvable.

[0027]A layer insulation agent has the desirable adhesives for nonelectrolytic plating. The thing which comes to distribute the heat resistant resin particle by which curing treatment of the fusibility was carried out to acid or an oxidizer into poorly soluble heat resistant resin as adhesives for

nonelectrolytic plating at acid or an oxidizer is the optimal. This is because a fox hole anchor can be formed in the surface and adhesion with a conductor circuit can be improved by roughening and removing the heat resistant resin particle of fusibility to acid or an oxidizer.

[0028]The complex of the thermosetting resin sensitization-ized as poorly soluble heat resistant resin to acid or an oxidizer, or the thermosetting resin and thermoplastics which were sensitization-ized is desirable. By sensitization-izing, it is because exposure can be formed and a viahole can be easily formed by development. By composite-izing with thermoplastics, toughness can be raised and improvement in the peel strength of a conductor circuit and the crack generation of the viahole portion by a thermo cycle can be prevented.

[0029]Specifically, the complex of epoxy acrylate and epoxy acrylate which made the epoxy resin react to acrylic acid, methacrylic acid, etc., and polyether sulphone is good.

[0030]That [ epoxy acrylate's ] to which 20 to 80% of all the epoxy groups reacted to acrylic acid, methacrylic acid, etc. is desirable.

[0031]\*\* mean particle diameter as said heat resistant resin particle Heat resistant resin powder of 10 micrometers or less, The heat-resistant powdered resin particles and mean particle diameter the floc which mean particle diameter made condense heat resistant resin powder of 2 micrometers or less, and whose \*\* mean particle diameter are 2 micrometers - 10 micrometers \*\* A mixture with heat resistant resin powder of 2 micrometers or less, \*\* Even if the surface of heat resistant resin powder whose mean particle diameter is 2 micrometers - 10 micrometers has little mean particle diameter either as for heat resistant resin powder of 2 micrometers or less or inorganic powder, it is desirable to be chosen from false particle \*\* to which one sort is made to come to adhere. It is because these can form a more complicated anchor.

[0032]As a heat resistant resin particle, an epoxy resin, amino resin (melamine resin, urea resin, guanamine resin), etc. are good.

[0033]The epoxy resin can change the solubility to acid or an oxidizer arbitrarily by changing the kind of the oligomer, the kind of hardening agent, and crosslinking density.

[0034]For example, what carried out curing treatment of the bisphenol A type epoxy resin oligomer with the amine system hardening agent is easy to dissolve in an oxidizer. However, what stiffened novolak-epoxy-resin oligomer with the imidazole series hardening agent cannot dissolve in an oxidizer easily.

[0035]Although the acid used by the invention in this application has organic acid, such as phosphoric acid, chloride, sulfuric acid or formic acid, and acetic acid, especially organic acid is desirable. It is because it is hard to make the metallic conductor layer exposed from a viahole corrode when roughening treatment is carried out.

[0036]Chromic acid and permanganates (potassium permanganate etc.) \*\* of

an oxidizer is desirable.

[0037]In the invention in this application, the number of layer insulation agents may be [ two or more ]. When using two or more layers, there is the following gestalt.

[0038]1) In the layer insulation agent layer which it comes to provide between an upper layer conductor circuit and a lower layer conductor circuit, What was made into the two-layer structure which uses the side near an upper layer conductor circuit as the adhesives for nonelectrolytic plating with which it comes to distribute the heat resistant resin particle by which curing treatment of the fusibility was carried out to acid or an oxidizer into poorly soluble heat resistant resin at acid or an oxidizer, and uses the side near a lower layer conductor circuit as poorly soluble heat resistant resin at acid or an oxidizer.

[0039]In this composition, even if it carries out roughening treatment of the adhesives layer for nonelectrolytic plating, it roughens too much, and between layers is not short-circuited.

[0040]2) In the layer insulation agent layer which it comes to provide between an upper layer conductor circuit and a lower layer conductor circuit, Embed filling resin material between lower layer conductor circuits, and a lower layer conductor circuit and the surface of this filling resin material are made to become the same flat surface, What was made into besides with the three-tiered structure which formed the adhesives for nonelectrolytic plating with which it comes to distribute the heat resistant resin particle by which curing treatment of the fusibility was carried out to acid or an oxidizer in a poorly soluble heat resistant resin layer at acid or an oxidizer into formation and the heat resistant resin of poor solubility [ top / it / oxidizer / acid or ] further.

[0041]In the multilayer printed wiring board 10 concerning this embodiment constituted as mentioned above. When the connection pad 12 on an insulating base material or the substrate 11 like a multilayer printed wiring board and the connection pad 17 on the layer insulation layer 14 are connected, And in each in the case of connecting the connection pad 17 and the terminal area 26 in the upper layer conductor circuit 24 on the layer insulation layer 20, From having connected via two or more viaholes 16 and 22, and sharing a land, and two or more viaholes 16 and 22 gathering, and being formed in this way. When some viaholes 16 and 22 are disconnected even if, it can connect certainly via the residual viaholes 16 and 22.

[0042]the probability that it will become poor disconnecting the multilayer printed wiring board 10 by this can be boiled markedly, and can be reduced.

[0043]As for this invention, it is needless to say for various improvement and modification to be possible within limits which are not limited to said embodiment and do not deviate from the gist of this invention. For example, in said embodiment, although the shape of the connection pad 17 used as the viahole land for forming the viaholes 16 and 22 and the terminal area 26 was constituted in the shape of an ellipse, it is not restricted in the shape of [ this

] an ellipse.

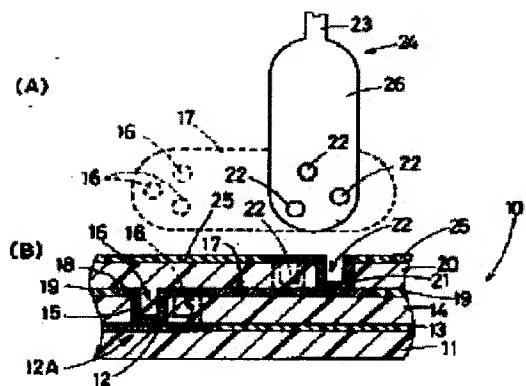
[0044]For example, as shown in drawing 2, it may form in a circle configuration as shape of the terminal area 26 in the upper layer conductor circuit 24, and the three viaholes 22 may be formed in three vertex positions of an approximately equilateral triangle in the terminal area 26 of this circle configuration. As shown in drawing 3, it may form in tear drop shape as shape of the terminal area 26 in the upper layer conductor circuit 24, and the three viaholes 22 may be formed in three vertex positions of an approximately equilateral triangle in the terminal area 26 of this tear drop shape. In addition, it can be made arbitrary shape, such as elliptical [ similar to each of such shape ].

[0045]

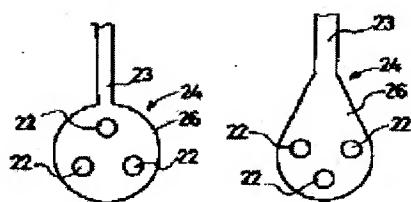
[Effect of the Invention]In the multilayer printed wiring board applied to claim 1 thru/or claim 4 as explained above. From being formed, after the viahole shared the land and have gathered, when a faulty connection occurs in some among two or more viaholes, it becomes possible to hold certainly the connection reliability of a lower layer conductor circuit and an upper layer conductor circuit as the whole patchboard. [ two or more ]

[0046]By facing this invention forming a viahole in a layer insulation layer, gathering and forming two or more viaholes as above, When a faulty connection occurs in some among two or more viaholes, the multilayer printed wiring board which can hold certainly the connection reliability of a lower layer conductor circuit and an upper layer conductor circuit as the whole patchboard can be provided.

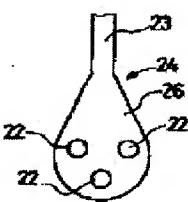
【図1】



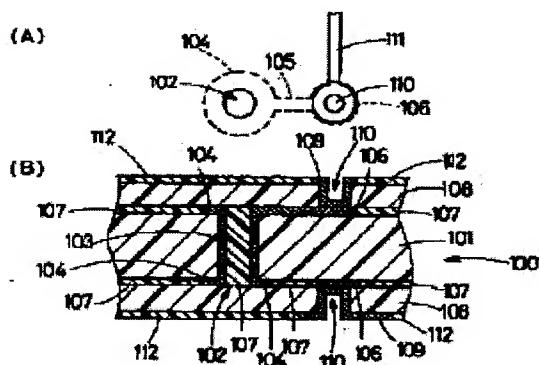
【図2】



【図3】



【図4】



【図5】

